BUSITEMA UNIVERSITY
Pursuing Excellence

FACULTY OF ENGINEERING

DEPARTMENT OF TEXTILE AND GINNING ENGINEERING

FINAL YEAR PROJECT REPORT

STUDYING THE THERMAL AND COMPRESSIVE STRENGTH PROPERTIES OF A SISAL REINFORCED GYPSUM COMPOSITE FOR BUILDING INSULATION.

By

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ABSTRACT

In this current era, there are some concerns of using synthetic fibres in regards to their impact on the environment since they are non-recyclable and non-degradable. There are many attempts by various groups of engineers and researchers to use natural fibres in engineering applications, in the hopes of replacing synthetic fibres with natural fibres. In this project, the possibility of using natural fibres in place of synthetic insulators is investigated in terms of their compression strength and thermal behaviour. Sisal fibres are selected as reinforcement for gypsum. To gain high interfacial adhesion of the sisal fibres with gypsum, sisal was treated with 6% NaoH. The composites were fabricated with fiber mass fraction ranging from 0,1,3,5 and 6%.

Central composite design (CCD) of response surface methodology (RSM) was used to model the relationship between the responses (compressive strength and thermal insulation) and factors (fibre mass fraction and composite treatment temperature) from which the experimental runs (13) were obtained. This was done using Minitab software. Compressive strength test was done according to ASTMC 39 and thermal behavior according to ASTMC 518

From the compressive test, it was observed that the addition of fibres to the gypsum matrix improves the compressive strength and resulted in reduced brittleness with an optimum fibre mass fraction 4.5 % at a treatment temperature of 242°c. The thermal behaviour result showed that pure gypsum was found to have the lowest insulation. The thermal insulation of the composites increases with the increment of fibre mass fraction. Treatment temperatures below 400°c does not significantly affect the thermal and compressive strength of the composite. sisal fibres as reinforcement on gypsum produces composites suitable for building insulation at treatment temperatures less than 200°c and fiber mass fraction less than 7%.

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DEDICATION

I dedicate this report to my beloved mum CHEROP JUSTINE and my father CHEROP STANLEY who have seen me through my academic struggle up to this point in my career

DECLARATION

I CHEBET DIANA, declare that the work presented in this report is my own and has never been presented to any University or higher institute of learning for any academic award.

Signature.....

Date.....16th/ Dec/2020.....

APPROVAL

This research project report has been submitted to the Department of Textile and Ginning Engineering for examination with approval from the following supervisors:

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RSM: Response surface methodology

CCD: Central Composite Design

ANOVA: Analysis of variance

ASTM: American Standard Test Method

1 CHAPTER ONE: INTRODUCTION

This chapter presents the general information about the research topic giving its background, problem statement, objectives, and significance of study, study scope and justification

1.1 BACKGROUND

Currently in Uganda and the rest of the world, there is a growing attention in the evolution of natural fibres for industrial and construction applications by both engineers and researchers (Begum K & Islam MA, 2013). Many efforts are focused on the possibility of replacing synthetic fibres like carbon, aramid and glass with the more natural fibres in various applications.(Mahir, Keya, Sarker, Nahiun, & Khan, 2019)

This is because of the need to establish a viable and sustainable alternative to synthetic fibers due to eco-legislation and keenness towards eco-friendly materials.(Jesuarockiam, Jawaid, Zainudin, Hameed Sultan, & Yahaya, 2019).

synthetic fibres have proved to be non biodegrable when disposed to the environment, and at the same time they costly to purchase(Raman Sharma & Sharma, 2014).Recent research has also shown that some of them like fiberglass pose threats to human health when it comes into contact with the human body(Muneri, 2011).

Natural fibres possess good properties, suitable to be used as engineering materials. These properties include high strength-to-weight ratio, low cost, less health hazards, obtained from renewable resources (R. Alajmi, Yousif, Alajmi, & Shalwan, 2019), Corrosion resistance, and good insulation properties (Teja, Ramana, Sriramulu, & Rao, 2016). Particular interest for using natural fibres currently is inform of reinforcing these fibres in a composite material for whichever application it may be required for.

A composite

This is a material made by combining two or more natural or artificial elements (with different physical or chemical properties) that are stronger as a team than as individual players(Donald

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